DE&S SAFETY AND ENVIRONMENTAL BULLETIN (SEB)

Serial Number: 064

Keeping our Safety and Environmental Practitioners informed

Use of Carbon Quantification Tools in Acquisition Environmental Management

When it takes effect:	Immediately
Valid for:	Until rescinded
Point of contact:	DES EngSfty-QSEP-EPSA-SA ATL DESEngSfty-QSEPSEP-EnvTeam@mod.gov.uk Spruce 2c, MOD Abbey Wood #1260

This SEB has been produced to provide clarity and guidance on how to identify and source suitable carbon tools to quantify carbon footprints of Products, Systems and Services (PSS).

1. A ‘carbon tool’ is a digital calculation tool which translates data about an activity (e.g., burning fuel) into a carbon emission value, usually in kilogrammes of carbon dioxide equivalent (kg CO_2e)[1]. A carbon[2] calculation is a simple multiplication between activity data (a measure of the activity being assessed, for example litres of fuel) and an emission[3] factor (how much carbon is emitted per unit of activity data).

For example: 1,000 kg steel (activity data) x 1.55 kg CO_2e / kg (emission factor) = 1,550 kg CO_2e (carbon emissions)

2. When using a carbon tool, users typically input activity data and select the most appropriate emission factor from the tool’s internal database. Most tools will allow multiple emission sources to be added, building up a picture of a larger system and generating a carbon footprint.

[1] CO_2e is a standardised unit of measurement that is used to enable different Greenhouse Gases (GHG) to be added together or compared; it uses the Global Warming Potentials (GWP) of different GHGs relative to Carbon Dioxide (CO_2) (with a GWP of 1), typically over a 100-year period. The seven GHGs listed in the Doha amendment of the Kyoto Protocol are CO_2, methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and nitrogen trifluoride (NF_3).
[2] For the purpose of brevity within this SEB, the term ‘Carbon’ should be taken to mean ‘Carbon Dioxide Equivalent (CO_2e)’.
[3] Also known as a carbon or conversion factor.

WHY USE A CARBON TOOL

3. Quantifying carbon emissions allows decision makers to understand the differences between capability options, identify carbon hotspots (activities which produce a high proportion of overall emissions) and opportunities for carbon reductions and demonstrate the through-life impacts of decision-making. Carbon tools can be used to estimate through-life carbon emissions during the Pre-Concept, Concept and Assessment phases of the Acquisition Lifecycle. They can also be used to quantify and report on actual measured carbon emissions through the Demonstration, Manufacture, In-Service and Disposal lifecycle phases. Estimating and quantifying carbon emissions helps to better understand the environmental performance of PSS and can support future decision-making for new acquisitions.

4. Sometimes it is possible to qualitatively estimate the impact of carbon emissions without having to carry out carbon calculations; for example, greater fuel efficiency is likely to lead to lower operational carbon emissions. It is also possible to carry out carbon calculations manually. Often though, it is not obvious what the magnitude of carbon emissions from a PSS might be. This can make decision-making in relation to carbon emissions difficult and prevents clear understanding of the full environmental impact of PSS.

WHAT MAKES A GOOD CARBON TOOL

5. Carbon tools are developed to serve different purposes in different sectors and are therefore applicable to different use cases, for example focussing on embodied or operational carbon emissions. When sourcing a carbon tool, there are a number of key questions which should be considered:

a. Has the user clearly articulated the purpose of using a carbon tool and how this contributes to the aims and objectives of the PSS being assessed?

b. Does the user understand the specific purpose for a carbon tool and the data available?

c. Does the carbon tool meet the needs of the user and suit the data requirements at the current lifecycle phase?

d. Is the carbon tool robust and representative?

e. Is the model “open” and transparent? (i.e., are the calculations performed and conversion factors used presented in the output?).

6. Any carbon tool used should be aligned to a relevant published standard, particularly when it comes to the scope and boundaries of the assessment. For both PSS and infrastructure, a carbon tool should enable a methodology aligned with a lifecycle assessment (LCA) standard. The adoption of a tool aligned to a LCA standard will ensure consideration of carbon emission throughout the life of an asset, from concept to end-of-life disposal. It is recommended that:

a. PSS should be aligned to a product focussed LCA standard; and

b. Infrastructure should be aligned to a LCA standard that covers all buildings and infrastructure throughout the built environment. See JSP850 Infrastructure and Estate [1] for further infrastructure guidance.

7. In addition to a LCA approach, any assessment of lifecycle carbon should follow the guidelines and requirements outlined within ISO 14040 [2] and ISO 14044 [3]. Selecting a carbon tool which is aligned with these standards gives confidence that the scope and boundaries of the assessment will be robust, representative, auditable and repeatable. Table 1 below provides a selection of authoritative published carbon accounting methodologies and standards that should be used to facilitate the quantification of whole life carbon emissions of PSS and infrastructure. It is not required to follow multiple standards; they are all based on the same principles.

Table 1 - Authoritative published carbon accounting methodologies and standards

Methodology / Standard	Applicability	Further Information
GHG Protocol Product Life Cycle Accounting and Reporting Standard	PSS focussed	Further information can be found at - Product Standard | GHG Protocol
PAS 2050 - Specification for the assessment of the life cycle GHG emissions of goods and services	PSS focussed	Further information can be found at - PAS 2050:2011
ISO 14067 – GHGs, carbon footprint of products, requirements and guidelines for quantification	PSS focussed	Further information can be found at - ISO 14067:2018
BS EN 17472:2022 – Sustainability of construction works. Sustainability assessment of civil engineering works. Calculation methods	Infrastructure focussed	Further information can be found at - BS EN 17472:2022
RICS Professional Standard for Whole Life Carbon Assessment for the Built Environment	Infrastructure focussed	Further information can be found at - RICS WLCA for the built environment

8. The emission factors which are contained within the carbon tool should be examined. They should be clearly visible with citations provided, so that quantification is transparent. The emission factors and assumptions used within the carbon tool should be sourced from authoritative published sources (see Table 2) where possible, and should be representative of the activities the user is trying to assess. Elements of representativeness to consider include:

a. Temporal representativeness (are emissions factors up to date, do they reflect the time period the activity will be occurring in);

b. Geographical representativeness (for example, using the electricity grid intensity factor specific to the country the activity is taking place in); and

c. Technological representativeness (do they sufficiently reflect the actual technologies which will be used in the activity).

9. It is also important to understand what elements of the lifecycle the emissions factors include. For example, carbon emissions associated with electricity use are often split into the generation of the electricity and then the transmission and distribution of that electricity. If a tool contains the ‘wrong’ emission factor for the user’s purpose, it might lead to an over or under-estimation of carbon emissions.

10. It is also important to use emission factors which incorporate the appropriate Global Warming Potential (GWP) time horizon. If non-CO_2 GHGs are being reported, the GWP with the appropriate time horizon must be selected. A 100-year time horizon is recommended, in line with the GHG Protocol, Intergovernmental Panel on Climate Change and UK Department for Energy Security and Net Zero. Table 2 below provides a selection of authoritative published sources for emission factors that could be used to support the quantification of carbon emissions.

Table 2 – Authoritative published sources of emission factors to support carbon quantification (non-exhaustive)

Emission Factor Source	Applicability	Further Information
Department for Energy Security and Net Zero (DESNZ)	Operational emissions	Updated on an annual basis Further information can be found at - DESNZ Conversion Factors 2023
Inventory of GHG & Energy (ICE)	Embodied materials and product emissions	Further information can be found at - ICE Emission Factor Database
BS EN 15804 – Environmental Product Declarations (EPD)	Product emissions	Further information can be found at - BS EN 15804 (EPDs)
GHG Protocol GWP values	Provides 100-year time horizon GWPs relative to CO_2	Further information can be found at - Global Warming Potential Values
DESNZ energy and emissions projections	When estimations of future electricity use are made, DESNZ updated energy projections should be used for the relevant year	Updated on an annual basis Further information can be found at - Energy and emissions projections
GHG Protocol third-party emission factor databases	Suitable for quantifying product lifecycle and supply chain emissions when other authoritative	These databases are not officially endorsed and users should carefully check the documentation to make sure the emission factors used are appropriate to the scope of assessment

	sources are not available	Further information can be found at - Life Cycle Databases

SOURCING A CARBON TOOL

11. The user must consider the aims of the quantification, the level of data available and investigate whether the identified carbon tool is suitable. Carbon tools often fall into two categories; detailed, bottom-up calculators which require lots of specific information and high-level top-down calculators which are heavily based on assumptions and benchmark data. Table 3 outlines the different categories of carbon tools and their benefits and challenges.

12. Commercial Off The Shelf (COTS) carbon tools are available for both product and infrastructure LCA. The advantage of using a COTS carbon tool is that the user can utilise a pre-populated database of emission factors and assumptions to quickly generate a carbon footprint. A COTS carbon tool also provides a ready structure for calculations and may offer dashboards and other reporting features which would be time-consuming to generate from scratch. Some COTS carbon tools can be bespoke to specific sectors and provide tailored reporting templates and emissions factors to accelerate the quantification process. Contact the Environmental Protection and Sustainable Acquisition (EPSA) Team if further guidance is required on sourcing Carbon Tools.

Table 3 - Types of carbon tools

Category of Tool	Benefits	Challenges
High-level, top-down calculator	Useful in early project stages to guide initial options comparisons Useful in situations where limited project information is available Quick to use and can often be used 'live' in a project meeting or workshop	Large quantity of assumptions and generic benchmark data used mean results have limited accuracy Typically do not allow for comparison of detail, for example specific components, materials, or sourcing locations Assumptions and emission factors are often sector-specific and may not be applicable in a defence context
Detailed, bottom-up calculator	Useful as projects develop and greater detail becomes available Useful when comparing specific and / or bespoke components Useful for reporting on 'actual' emissions with monitored activity data Can give high accuracy	Reliant on the availability of detailed input data Greater risk of 'user error' and greater level of SQEP required to carry out calculations Time-consuming to gather data and carry out calculations, makes them a less suitable tool for options comparison

FUTURE DEVELOPMENTS

13. The EPSA Team is currently developing an Emissions Management Framework (EMF) proof of concept to demonstrate a process to quantify, manage and reduce whole life GHG emissions of PSS. Additionally, policies, processes and tools are being updated and developed to facilitate Delivery Teams to deliver PSS with sound environmental performance, in accordance with Safety and Environmental Protection (S&EP) Leaflet 18 [4].

14. A key artefact of the EMF will be a GHG Accounting Technical Standard. The Standard will provide detailed instruction on how to quantify GHG emissions associated with PSS by MOD and its supply chain. It will be supported by the development of a data platform, storing emissions data, enabling the monitoring of data trends, identification of emission hotspots and opportunities and the feedback of emissions data into early life cycle decision making.

15. The intent is that the Carbon Tools SEB will be integrated into wider EMF guidance in the future.

ACTIONS TO BE TAKEN

16. Until the EMF is a fully functional accessible process, the current guidance outlined in this SEB should be followed when:

   a. Selecting a tool to quantify carbon emissions of PSS;

   b. Reviewing the suitability of a tool that has been offered by a supplier to quantify carbon emissions of PSS.

17. For those also selecting a tool to quantify carbon emissions of infrastructure, they should additionally consult with JSP850 [1] for the latest policy and guidance.

Released under the Authority of

Michael Brown
DES EngSfty QSEP EPSA TL

REFERENCES

1. JSP 850: Infrastructure and Estate, Policy, Standards and Guidance, Version 2.44, May 2024 - JSP 850: Infrastructure and Estate, Policy, Standards and Guidance

2. ISO 14040:2006: Life cycle assessment principles and framework, Edition 2, July 2006 - ISO 14040:2006 - Environmental management — Life cycle assessment — Principles and framework

3. ISO 14044:2006: Life cycle assessment requirements and guidelines, Edition 1, July 2006 - ISO 14044:2006 - Environmental management — Life cycle assessment — Requirements and guidelines

4. DE&S Safety and Environmental Protection (S&EP) Leaflet 18/2023: Delivering Sound Environmental Performance in DE&S Acquisition, Version 1.0, Date of Issue: August 2023 - 20230825 - S&EP Leaflet 18 2023 - O.pdf (mod.uk)